statement, "All gases contain the same number of molecules;" the molecule may then be formed—

It may be by 1 atom, as Hg, Cd, &c.
" 2 atoms, as H, Cl, O, &c.
" 3 " " Ozone.
" 4 " " P, A, &c.

What is there in this, M. Berthelot asks, more logical than in his own method? or in what may it be allowed to constitute a modern chemistry in distinction to that of Lavoisier and of Gay-Lussac?

In answer to M. Berthelot, M. Wurtz discusses in a further communication the thermic considerations brought forward by the former in his explanation of the reciprocal reactions already alluded to of hydride of copper with hydrochloric acid and peroxide of hydrogen with other peroxides. M. Wurtz, although acknowledging the value of these considerations, considers the reasoning incomplete, by merely saying that hydride of copper is an endothermic compound; it would be necessary to prove in addition why such bodies, having a greater capacity of heat than their constituent elements, can be formed or exist at all. He maintains that his own ideas admit of the intervention in the thermic considerations relative to the formation of such bodies as peroxide of hydrogen, ozone, chloride of nitrogen, &c., the work done in doubling the molecules of oxygen, O_2, chlorine, Cl_2, and nitrogen, N_2; this work causing an absorption of heat. He brings forward the ideas of M. Favre regarding the formation of bodies with an absorption of heat and alludes to the idea of this latter chemist of representing free oxygen as O_2 and nascent oxygen as O, the latter being more active in consequence of being supplied with more heat from what he calls the "segregation" of the molecule. M. Wurtz concludes that the thermical reasoning instead of being opposed to the atomic conception materially assists it.

In passing to the further objections made by Berthelot to expressing the reaction of potassium and hydrochloric acid as—

$$2HCl + K_2 = 2(KCl) + H_2,$$

M. Wurtz explains it as a necessity to render it comparable to the reaction—

$$2HCl + Zn = ZnCl_2 + H_2,$$

this representing 63·5 of zinc or two equivalents, having doubled the equivalent of zinc, as also of certain other metals for two reasons: firstly, to allow them to accord with the law of Dulong and Petit; and secondly, to satisfy Avrogadro's law. M. Wurtz evidently considers M. Berthelot in the position of almost wishing the abolition of Dulong and Petit's law, and explains that although the product of the specific heats into the atomic weights may not always prove rigorously constant, still they are sufficiently near, it being difficult to obtain one and the same metal under conditions strictly comparable. He wishes therefore to retain the law of Dulong and Petit as a check for the determination of the atomic weights. The notation of equivalents, he thinks, contains certain inconsistencies, and complains that no direct response has been made by its upholders to this point, which is really at the foundation of the discussion; they have only objected to atomic notation as introducing vexatious complications in expressing the reactions of mineral chemistry.

To M. Berthelot's reproach that he has confounded the notion of a hypothesis with that of a law, M. Wurtz replies in the following sentence:—"Je le remercie de cette leçon de philosophie; mais je ne crois pas en avoir besoin." He admits, for his own part, his knowledge that the notion of atoms and molecules is only a hypothesis, one which it is allowable to make on the constitution of matter, and essentially dependent on another, that of the existence of the ether. M. Berthelot believes the atomic hypothesis ill-founded, as atoms and molecules have never been seen, but for the same reason it would be as difficult to imagine the ether. To reject this latter hypothesis it would be necessary to adopt that of continuous matter of differing degrees of density filling all space, and M. Wurtz repeats that chemical notation, the point in question, is independent of such hypotheses.

The notion of atoms and molecules would have to be replaced by that of infinitely small vibrating masses, and at the basis of the notion of equivalent quantities lies the same idea of finite particles. What is really necessary is the choice of exact numbers to express the relative weights of these particles by whatever name they may be called; according to M. Wurtz they are of two orders: isolated, he calls them atoms; combined, molecules. Is this, he asks, an ill-defined idea?

In a discussion like the present, which has existed for so long, and which doubtless will still be continued, it is extremely difficult to balance accurately the arguments used by the upholders of the different theories. Although many and forcible reasons have been brought forward by both contending parties, we fear that no final victory has been gained by either side. M. Berthelot objects to the idea of molecules and atoms, but he evidently does not wish to exclude entirely imagination and hypothesis from scientific reasoning, and deems, as is probably the case, that the fundamental conceptions of the two chemical schools may not differ so much in that matter as perhaps M. Wurtz at present imagines.

The point on which the real difference seems to exist is, in perceiving the true importance of such representative conceptions, and placing them in the position they should occupy in human knowledge. J. M. T.

THE GREENLAND FOEHN[1]

ONE of the chief peculiarities of the meteorology of the Arctic regions, and particularly of West Greenland, is the great variability of the temperature in the cold part of the year. There may not only be a very considerable variation in the average monthly temperature from year to year, but sudden changes from the severest cold to fresh weather, and *vice versâ*, often occur several times in the course of the same month.

Dr. Pfaff has carried on meteorological observations at Jacobshavn for twenty years, and these show that the average temperature of 1872 was −8·7° C., and of 1863 − 31·6°, a difference accordingly of almost 23°—an almost inconceivable variableness to us West-Europeans; being, for instance, nearly as great as the difference between the coldest winter month and the warmest summer month at Copenhagen within the same period. The observations referred to also exhibited the most remarkable instances of daily variations. In February, 1860, the thermometer rose on three different occasions more than 25° C. in the course of twenty-four hours.

These singular and sudden rises of temperature almost always stand in connection with a veering of the wind to south-east and east. It may appear very surprising, that the temperature rises with the wind blowing from the high land in the interior of Greenland, which is covered with eternal snow and ice. We need not, therefore, be surprised that old authors have endeavoured to explain this phenomenon by supposed volcanoes in action, or even by a comparatively very mild climate in the interior of Greenland—an hypothesis which it is, however, quite impossible to maintain on meteorological grounds. For every continent in high latitudes must necessarily, from the radiation of heat, be colder in its interior than at the coast where the sea makes the climate milder.

A glance at the map shows that Greenland lies between regions of the earth where, especially in winter, the temperature is exceedingly different. "To the west and

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[1] Abstract of a paper by Hoffmeyer in the Danish Geographical Society's *Journal*, Part I., translated from *Naturen* of June, 1877 (Christiania).

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south-west there occurs at this season of the year in Labrador, the Hudson's Bay territories and the Arctic Archipelago, so great a fall of temperature, that the mean temperature of January sinks from – 20° to – 35° C.; to the east and south-east, on the contrary, the Gulf Stream, even in mid-winter, maintains the temperature in the Atlantic at from 0° to 5° C., so that the superincumbent air can scarcely be supposed in general to be cooled under the freezing-point. Lying between such opposite varieties of temperature, the climate of Greenland must necessarily be in a high degree dependent on the prevailing direction of the wind at every particular period; all winds from south by west to north-east may bring comparative cold, but east and south-east winds, on the contrary, heat, and this ought specially to hold good of the south-east wind, both because it comes from the warmest part of the neighbouring Atlantic Ocean, and also because it has the shortest way to travel over the ice-deserts of the interior to reach the western coast. The character of the winter in Greenland will therefore certainly depend on whether the south or the east wind has prevailed during the course of it."

These explanations go a great way indeed, but still are not altogether sufficient. "Thus, when at Jacobshavn, shortly before July, 9° C. of heat are recorded during a south-east storm, while the normal temperature is – 12° C.; this high temperature cannot be derived alone from the Atlantic nearest in the south-east to Greenland; for it is quite improbable that the air could have so high a temperature at this season, and even if it may be supposed to pass over Greenland in the short space of eight to ten hours, it must by the way suffer a greater or less cooling by contact with the cold ice masses. Indeed if we go down to South Greenland we will there, in the month of December, be able to observe over 14° C. of heat, a temperature which we cannot simultaneously find in the Atlantic much nearer than at the Azores, and it cannot be supposed that the air has travelled from these islands to Greenland with its temperature unchanged."

"There are also other properties, besides its high temperature, which specially characterise the south-east wind in Greenland. For it appears always to be very dry; the snow melts away from the low country without any running water being visible. The storm begins first on the mountain-tops, where the snow is seen whirling high in the air, and then it afterwards works itself down in the fiord valleys."

These relations drew the writer's thoughts to other regions of the earth. On the northern slopes of the Alps a stormy southerly wind sometimes begins to blow very suddenly, which, from the snow-covered summits, hurls itself with irresistible force through the valleys which lead towards the north, and throws the Alpine lakes into frightful commotion. This wind, which is named *Foehn*, has, although it comes from a snowy region, an unusual warmth and dryness. Prof. Dufour has shown that during a *Foehn* which raged during the 24th and 25th September, 1866, the temperature was 6° to 9° C. over the normal in northern Switzerland; indeed at the town of Zug, although it lies 440 metres above the level of the sea, the temperature was higher than it was at the same time both north and south of the Alps. The unusual heat and dryness of the Foehn is also shown by the circumstance that the boundary of the snow in the valleys is seen to have receded very considerably when the storm subsides; it is therefore called, on that account, "the great snow melter."

At the same time that the southerly wind is found as a warm and dry *Foehn* on the northern side of the Alps, there blows, on the other hand, on the southern slopes of the mountains a humid sirocco, generally accompanied by an enormous fall of snow.

Several years back Dr. Hann, of Vienna, solved this enigma in a highly satisfactory way.

We know that the pressure of the atmosphere decreases upwards; when, therefore, a mass of air is forced by any cause to raise itself from the surface of the earth to a certain height, it will be subjected to a constantly diminishing pressure, and will accordingly expand, but as every expansion is a work which is accompanied by a consumption of heat, the air is cooled as it rises. As long as the cooling is not greater than that the air can retain its watery vapour, the heat will, according to calculations which have been confirmed by observations, diminish almost exactly 1° C. for every 100 metres the air rises. On the other hand, if the dew-point is exceeded, so that the watery vapour forms clouds, rain, or snow, the moisture will pass from the form of vapour to the fluid or solid state, whereby the combined heat is set free. The cooling from this moment proceeds much more slowly, and it may, within the limits of which we have experience, be stated as about ½° C. for every 100 metres.

When a mass of air, on the contrary, sinks towards the surface of the earth, it comes under higher pressure, is compressed, and consequently heated. Its temperature will rise more and more above the dew-point, and moisture will, with continually increasing ease, be held dissolved in the state of vapour. The heating during the whole descent will be 1° C. for every 100 metres.

These physical laws explain the properties of the *Foehn*. The air comes from the Mediterranean saturated with moisture, and passes over the summits of the Alps.

"Leaving out of consideration the cooling which goes on by the way, partly by radiation, partly by contact with mountain masses, a simple calculation will give the result that the temperature of a south wind will be about as many half degrees Centigrade higher at the north foot of the Alps than at the south foot, as the height of the mountain chain contains hectometres, for it is lowered half a degree for every 100 metres ascent, but raised one degree for every 100 metres descent."

These phenomena repeat themselves on Greenland. The writer sketches in detail a *Foehn* period which lasted eighteen to twenty days in the end of November and beginning of December, 1875. Jacobshavn was then for quite eight days warmer than North Italy. Upernivik, which lies about 10° to the south of the English North Pole Expedition's wintering station, was during the darkness of the Polar night warmer than the south of France. Unfortunately all direct observations from the uninhabited east coast of Greenland and the nearest parts of the Atlantic are wanting; but it may, however, be shown that during the period referred to a strong south-east wind blew from the sea over the land. For the so-called Buys-Ballot law in its simplest form teaches that the wind always blows so that it has the greater pressure of the atmosphere on its right, and that the more unequally the pressure is distributed the greater is the velocity of the wind. Now just during the days in question the barometer was much higher in Iceland than at Davis Straits. Over the tract lying between these places there had thus prevailed a strong south-east wind.

NOTES

OUT of above ninety candidates, Mr. James Edward Henry Gordon, B.A., of Caius College, Cambridge, has been selected by the Council of the British Association to be recommended to the Association as Mr. Griffith's successor in the important position of Assistant Secretary.

THE fiftieth *Versammlung deutscher Naturforscher und Aerzte* takes place at Munich on September 18–22. The following is the general programme:—Sept. 17, evening: Social gathering in the large saloon of the Rathhaus. 18: General session in the Odeon; address of welcome from Dr. v. Pettenhofer, addresses by Prof. Waldeyer, of Strassburg, on "C. v. Baer and his

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